NOTES AND REVIEWS

SVERRE PETTERSSEN. *Weather Analysis and Forecasting.* New York (McGraw-Hill Book Co.), 1940. 505 pp., 249 figs.

The purpose of this book is to assemble the practical methods now available (most of them developed comparatively recently) for forecasting weather on the basis of physical principles. A general knowledge of meteorology is presupposed, and only those aspects of meteorology are treated which experience has shown to be directly applicable to actual forecasting. The book embodies the original theoretical investigations and the accumulated experience of the author in synoptic meteorology over a long period of years. The author's methods are distinguished by the introduction of precise formulations of synoptic concepts, in terms of quantities that can be measured in ordinary meteorological observation.

The first chapter contains a brief treatment of 17 different quantities in terms of which the physical characteristics of air masses may be described. It is followed by a chapter on the theory of atmospheric stability, convective phenomena, and fog, and the uses of various thermodynamic diagrams. Chapter III discusses the source regions, production, classification, and transformation of air masses. Two chapters are then devoted to the fundamental dynamical equations of motion, the gradient wind, kinematic analysis, frontogenesis, and the characteristic phenomena of fronts, followed by a chapter on waves and the wave theory of cyclones. Chapter VIII is on isentropic analysis, and was written by Jerome Namias. Two chapters on the kinematic forecasting of the displacements of pressure systems, fronts, and air masses, and the forecasting of deepening and filling, are followed by the concluding chapter on the actual technique of analysis and forecasting, with several examples.

EDMUND SCHULMAN. A Bibliography of Tree-Ring Analysis. *Tree-Ring Bulletin* (University of Arizona, Tucson), Vol. 6, No. 4, April 1940. This entire issue of the *Tree-Ring Bulletin* is devoted to a 12-page bibliography comprising 412 titles on tree-ring analysis.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR AUGUST 1940

[Climate and Crop Weather Division, J. B. KINCER in charge]

AEROLOGICAL OBSERVATIONS

By EARL C. THOM

The mean surface temperatures during August (Chart I) were above normal over most of the United States; temperatures were slightly below normal, however, over considerable of the western part of the Mississippi River Valley area, and a small area in northeastern Texas had temperatures from 2° to 3° (F.) below normal. Temperatures were also below normal over the northern Atlantic States, with temperatures about 3° below normal in New Jersey and eastern New York. The warmest area for the month, relative to the normal, was Montana, western Wyoming, northern Utah, and northern Nevada with mean temperatures about 5° above normal in most of this area.

At the 1,500-meter level the direction of the resultant winds for the month (chart VIII) was considerably to the north of normal (clockwise turning) over the Atlantic Coast States and also over eastern Texas. The direction of the resultants for the month had the opposite turning over the Great Lakes and the east central states. The same general diversion from normal in the direction of the resultant winds for August occurred at the 3,000-meter level as at the 1,500-meter level, except that the shift of direction to northward was more pronounced over eastern Texas and extended over Oklahoma. Based on data for the small number of stations for which 5 a. m. normal records are at hand, the direction of the resultant wind for the month at 5 p. m. was south of the corresponding 5 a. m. normal over the eastern half of the country and over the extreme northwest with the opposite shift occurring over the remainder of western United States.

The 5 a. m. resultant velocity for August was in general below the normal resultant velocity over the United States at both the 1,500-meter and the 3,000-meter levels. The resultant velocity was about 3 meters per second below normal at the 1,500-meter level along the northern Atlantic coast and at Fargo, N. Dak., while the corresponding velocity was slightly over 4 meters per second below normal for the 3,000-meter level at Fargo and Sault Ste. Marie. At the 5,000-meter level the 5 p. m. resultant normal was considerably above the corresponding 5 a. m. velocity over the South Central States and was considerably below this normal over the Northeast and North Central States.

Again in August the areas having a decided shift in direction of the resultant winds from normal, at both the 1,500-meter and the 3,000-meter levels, agree well with the areas having corresponding surface temperature departures for the month.

At the 1,500-meter level the direction of the 5 p. m. resultant for the month was south of the corresponding 5 a. m. resultant (counterclockwise turning) over a large part of the United States. The opposite shift in resultant wind direction at this level occurred over the Great Lakes and part of the North Atlantic States, over part of the Southeastern States and over most of the extreme western and extreme southwestern portions of the country. At the 3,000-meter level the shift of the resultant wind to the northward from 5 a. m. to 5 p. m. was noted over larger areas, this shift having occurred over the Gulf coast, southern Atlantic coast, part of the east Central States, over the Pacific coast and most of the Southwest and West Central States.

The changes in resultant velocity at 5 p. m. from those at 5 a. m. were well distributed at both the 1,500-meter and the 3,000-meter levels. At the 1,500-meter level, however, the West Central, the Central, and the Southeastern States all showed lower resultant velocities at 5 p. m. than at 5 a. m., the velocity departures in this area amounting to a decrease of Beaufort force one or two.

It is of interest to note that at Las Vegas, Nev., the pilot balloon observations attained a height of 18 kilometers or over on 16 days during the month and that the resultant wind, based on those observations was 118° (ESE), 2.0 meters per second for that level.

The upper air wind data discussed above are shown in table II and in charts VIII to XI.

At all levels from 3,000 meters up to at least 17,000 meters over the United States (table I) the highest mean monthly pressures for the month of August occurred over the extreme southwestern part of the country; the maximum occurred at Phoenix at most of these levels. At several of the levels above 8,000 meters, however, the mean pressure at other stations (Brownsville, San Diego, or El Paso) were the same as at Phoenix. The lowest mean monthly pressure occurred at Sault Ste. Marie at the 15,000-meter level as well as at all levels from 3,000 meters to 13,000 meters inclusive. At the 14,000-meter level the same minimum pressure, 151 mb., was recorded at Great Falls, Mont., and at Sault Ste. Marie, Mich., while 110 mb. pressure was recorded at three stations, Great Falls, Joliet, and Sault Ste. Marie, at the 16,000-meter level.

Mean monthly pressures were the same or lower in August than in July at most stations for all levels below 5,000 meters. At higher levels mean pressures were higher in August than in July over the eastern half of the United States and along the Pacific coast with little change over the rest of the United States. The station showing the largest increase in mean pressure at upper levels from July to August was Sault Ste. Marie, this increase being 4 mb. at 8,000 meters, 6 mb. at 11,000 meters, and 5 mb. at 14,000 meters over this station.

The greatest difference between the mean maximum pressure for August and the corresponding mean minimum was 12 mb. which occurred at the 8,000-meter level. The steepest pressure gradient at this level occurred between Lakehurst and Washington where a difference of 3 mb. was noted along a horizontal distance of less than 200 miles. Another steep pressure gradient, a difference of 5 mb., occurred between Sault Ste. Marie and Joliet.

At levels below 8,000 meters the mean temperatures were in general higher in August than in July over the Great Lakes and East Central States and along the Pacific Coast and were lower than in July over the balance of the country. Almost without exception mean temperatures were higher than in July at all thousand-meter levels from 9,000 meters to and including 13,000 meters. At the 14,000-meter level four stations in the eastern half of the country and one in the western half had mean temperatures in August lower than those in July. At levels from 15,000 meters to 18,000 meters inclusive, mean temperatures were generally lower than in July except that in the southwest temperatures were higher. At El Paso, for example, the temperature at these four levels averaged nearly 2° C. higher than in the previous month.

At levels below 5,000 meters mean temperatures were generally lower than in August of 1939 except over the Southeast, the Gulf Coast and over the West Central States where small increases in temperature from those of the preceding year were noted. At most of the thousand-meter levels from 5,000 to 14,000 meters inclusive, temperatures were lower than in 1939 at Oakland and at Joliet and were higher than 1939 at Denver and El Paso. At most other stations no marked temperature changes from the previous year were evident.

The maximum altitude of the level of mean freezing temperature for August was 5,100 meters over Phoenix and the minimum altitude of this level was 3,700 meters over Sault Ste. Marie. The altitude of mean 0° C. temperature was 4,900 meters or higher at all Weather Bureau Stations south of 35° N. latitude, while the corresponding altitude ranged between 4,400 meters and 4,800 meters for such stations in the United States between 35° and 45° latitude and was the same or lower for all stations north of this latitude belt. The altitude of the level of average freezing temperature was several hundred meters higher than in July over the eastern half of the country, the maximum increase of 800 meters occurring over Sault Ste. Marie.

The lowest free-air temperature at standard one thousand meter levels in August was −82.6°C. (−116.7° F.) recorded at 16,000 meters over Brownsville, Texas. Minimum temperatures of −70° C. (−94° F.) or lower were recorded at all radiosonde stations in the United States south of 35° N. latitude while the minimum recorded at all stations (except Lakehurst) north of this line was −70° C. or higher, with the highest minimum observed in the United States, −63.2° C. (−81.8° F.) occurring at Bismarck, N. Dak.

Table 3 shows the maximum free-air velocities and their directions for various sections of the United States during August, as determined by pilot-balloon observations. The extreme maximum for the month was 53.6 meters per second (119.9 miles per hour) observed over Huron, S. Dak. on August 5, 1940. This high wind was blowing from the west at an elevation of 9,540 meters (nearly 6 miles) above sea level. A maximum, 58 meters per second, for the month of August occurred last year over Huron, S. Dak. at 13,740 meters above sea level. In August 1938 a still higher maximum wind, 69.8 meters per second, was observed at an elevation of 2,660 meters over Havre, Mont.

Tropopause data for August showing the mean altitude and temperature of the tropopause at various stations are shown in table 4 and on chart XIII.

MEAN ISENTROPIC CHART [1]

Two anticyclonic eddies are the most prominent features of the mean isentropic chart ($\theta=314°$) for August 1940 (chart XII). The eastern cell is displaced southward of its usual position, resulting in above normal precipitation in the Middle and South Atlantic States, but with large deficiencies in New York and New England. Downslope motion is indicated by the resultant winds in the region west of the Rockies, where little or no precipitation occurred; but over the upper Mississippi Valley marked upslope components are shown, and as a consequence the precipitation was above normal. The large excesses in precipitation in Louisiana, as well as those in North Carolina and Virginia, were due largely to tropical cyclones the effect of which was not prolonged enough to show up on the mean moisture pattern.

The data for Medford, Oreg. were neglected in constructing chart XII because the mean there was based on only 18 observations.

[1] Prepared by the Research Division.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during August 1940*

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Bismarck, N. Dak. (505 m.)				Brownsville, Tex. (6 m.)				Charleston, S. C. (14 m.)				Coco Solo, C. Z.[1,2] (15 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	31	957	18.2	68	27	1,013	26.5	85	30	1,014	24.0	91	17	1,013	25.5	96
500					27	958	24.5	87	30	960	22.9	79	17	958	24.2	94
1,000	31	904	20.4	55	27	905	22.5	68	30	906	20.3	74	17	904	22.1	92
1,500	31	852	18.0	54	27	854	20.5	57	30	855	17.7	74	17	854	19.6	91
2,000	31	804	15.1	53	27	805	17.9	53	30	806	15.0	70	16	805	17.1	86
2,500	31	757	12.2	53	27	760	15.0	53	30	760	12.3	68	15	759	14.3	84
3,000	31	713	9.0	53	27	716	12.1	55	30	716	9.7	66	15	714	11.8	82
4,000	31	632	2.9	46	27	635	6.1	57	29	634	4.8	60	11	633	6.0	75
5,000	31	558	−3.8	40	27	561	−.2	55	29	561	−.6	56				
6,000	31	490	−10.4	36	27	495	−5.5	45	28	494	−6.2	51				
7,000	31	430	−17.4	32	27	435	−11.7	38	28	434	−12.1	47				
8,000	31	376	−25.1	31	27	381	−18.8	35	28	381	−19.1	47				
9,000	30	326	−32.8	29	27	333	−26.1	33	27	332	−26.7	46				
10,000	28	282	−40.3		27	289	−33.8	33	27	288	−34.9	44				
11,000	28	243	−47.3		26	250	−41.5		27	249	−43.0					
12,000	28	209	−52.7		25	216	−48.9		24	214	−50.8					
13,000	28	178	−55.5		25	185	−56.0		23	183	−58.1					
14,000	25	152	−57.5		24	158	−62.6		23	156	−64.1					
15,000	24	130	−59.1		24	134	−68.2		22	132	−68.7					
16,000	24	111	−59.1		23	113	−71.3		21	112	−69.3					
17,000	24	94	−58.9		23	95	−70.6		20	95	−67.3					
18,000	21	80	−57.1		20	81	−67.4		18	80	−63.9					
19,000	13	69	−55.8		20	68	−64.4		16	68	−61.3					
20,000	7	58	−54.6		17	58	−61.6		9	58	−59.3					
21,000	5	51	−53.1		12	49	−58.5		6	49	−57.6					
22,000					7	42	−55.7									

Altitude (meters) m. s. l.	Denver, Colo. (1,616 m.)				El Paso, Tex. (1,193 m.)				Ely, Nev. (1,908 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	31	842	18.3	62	21	882	23.6	49	31	811	17.5	28
500												
1,000												
1,500					21	852	23.3	47				
2,000	31	805	19.2	57	21	804	20.8	47	31	803	20.2	25
2,500	31	759	16.2	56	21	759	17.2	49	31	758	20.1	24
3,000	31	715	12.9	56	21	715	13.4	54	31	715	16.4	24
4,000	31	634	5.7	62	20	634	6.1	58	31	634	7.6	28
5,000	29	560	−2.0	66	20	561	−.8	63	31	560	−1.5	38
6,000	28	493	−9.0	65	20	495	−6.8	56	31	494	−9.7	45
7,000	28	433	−15.2	62	20	435	−12.7	53	31	433	−15.8	42
8,000	28	379	−22.0	59	20	381	−19.5	52	31	378	−22.9	38
9,000	28	330	−29.7	57	20	332	−26.9	51	31	329	−30.9	35
10,000	29	286	−37.8	55	20	288	−34.5	50	31	286	−38.5	32
11,000	28	246	−45.1		20	249	−42.3		30	246	−45.7	
12,000	26	212	−51.5		20	215	−50.0		29	212	−51.8	
13,000	26	182	−56.9		20	184	−56.9		29	181	−56.6	
14,000	25	155	−61.5		20	157	−62.8		29	154	−61.2	
15,000	23	132	−64.3		20	133	−67.1		29	131	−64.6	
16,000	22	112	−65.1		20	113	−69.1		28	112	−64.8	
17,000	19	95	−64.3		20	95	−68.1		26	95	−63.5	
18,000	18	81	−62.1		20	81	−65.7		25	80	−61.0	
19,000	16	69	−59.7		17	69	−62.7		19	69	−58.7	
20,000	9	59	−57.4		12	58	−60.0		12	58	−56.4	
21,000	6	50	−55.6									
22,000												

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Great Falls, Mont. (1,117 m.)				Joliet, Ill. (178 m.)				Lakehurst ,N. J.[1] (39 m.)				Medford, Oreg. (401 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	31	890	19.9	32	29	995	19.3	85	31	1,014	17.0	92	19	967	22.4	41
500					29	959	20.7	70	31	961	16.8	72	19	956	22.7	40
1,000					29	905	18.7	68	31	907	14.8	68	19	902	20.9	41
1,500	31	852	20.4	32	29	853	15.8	72	31	854	12.4	66	19	851	17.9	47
2,000	31	803	17.5	33	28	804	12.9	76	31	805	10.3	60	19	802	15.8	49
2,500	31	757	13.6	35	28	757	10.1	72	31	758	8.6	45	19	756	14.0	47
3,000	31	713	9.4	38	28	713	7.0	70	31	713	6.5	35	19	712	11.4	40
4,000	31	632	2.2	44	27	631	1.4	66	30	630	1.6	34	18	632	4.6	36
5,000	31	557	−5.0	42	26	557	−4.3	63	30	556	−3.7	25	18	558	−2.2	34
6,000	31	490	−11.0	42	26	489	−10.3	59	30	489	−9.7	22	17	491	−8.7	34
7,000	31	429	−19.0	40	26	429	−16.9	55	30	429	−16.4	26	17	431	−15.9	34
8,000	31	375	−26.8	40	26	375	−24.3	54	29	375	−23.5	38	17	376	−23.5	33
9,000	30	325	−34.9	38	26	326	−31.9	54	29	326	−31.0	32	17	327	−31.8	32
10,000	30	282	−43.1		26	282	−39.9		29	283	−38.5	16	17	284	−40.2	
11,000	30	242	−50.5		25	244	−46.9		29	245	−45.8		16	245	−47.8	
12,000	30	207	−55.6		24	209	−52.5		29	210	−53.2		15	210	−53.2	
13,000	30	177	−57.3		23	178	−57.0		29	179	−58.7		15	180	−56.7	
14,000	30	151	−59.0		23	152	−60.4		29	153	−62.4		15	153	−59.2	
15,000	29	129	−59.9		22	130	−62.3		29	130	−64.5		15	130	−61.7	
16,000	28	110	−60.0		21	110	−62.5		28	111	−64.4		14	111	−63.7	
17,000	26	94	−58.8		20	93	−61.7		27	95	−62.9		14	94	−63.1	
18,000	23	80	−57.3		18	79	−60.0		24	81	−60.8		14	80	−61.5	
19,000	16	68	−55.5		17	68	−57.7		23	68	−58.4		12	69	−59.7	
20,000	10	58	−53.7		11	57	−55.7		9	57	−56.2		8	58	−57.9	
21,000	6	49	−52.4		8	49	−54.2		6	48	−54.3		6	50	−56.5	
22,000																

Altitude (meters) m. s. l.	Nashville, Tenn. (180 m.)				Norfolk, Va.[1,2] (10 m.)				Oakland, Calif. (2 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	31	995	22.9	84	27	1,019	22.8	87	31	1,014	15.6	84
500	31	959	23.5	73	27	963	21.4	79	31	957	15.7	73
1,000	31	906	21.1	73	27	909	18.5	74	31	902	21.1	38
1,500	31	855	17.9	76	27	857	15.4	72	31	852	20.4	26
2,000	31	806	14.7	75	27	808	12.1	69	31	803	18.0	21
2,500	31	759	11.9	70	27	761	9.4	63	31	757	15.0	19
3,000	31	715	9.5	64	27	716	7.2	56	31	713	11.8	17
4,000	31	634	4.2	59	27	634	1.8	47	31	632	5.2	17
5,000	31	560	−1.4	57	26	559	−3.8	39	31	559	−1.8	17
6,000	31	493	−6.5	50					31	492	−8.8	16
7,000	31	434	−12.4	47					31	432	−15.8	17
8,000	29	380	−19.6	47					31	377	−23.5	16
9,000	29	331	−27.2	45					31	328	−31.8	16
10,000	27	288	−34.9	44					31	284	−39.4	16
11,000	26	248	−42.5						31	245	−46.2	
12,000	26	214	−49.9						30	210	−51.8	
13,000	26	184	−56.9						30	180	−56.5	
14,000	26	156	−63.0						30	154	−60.9	
15,000	25	133	−66.8						28	131	−64.1	
16,000	25	112	−68.4						26	111	−65.7	
17,000	21	95	−67.1						24	94	−64.7	
18,000	20	80	−64.6						22	80	−62.5	
19,000	17	68	−61.6						21	68	−59.7	
20,000	14	58	−59.0						19	57	−57.3	
21,000	9	50	−56.8						11	49	−54.8	
22,000									5	42	−53.3	

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during August 1940*—Continued

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level																											
	Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pearl Harbor, T. H.[1] [2] (6 m.)				Pensacola, Fla.[1] [5] (24 m.)				Phoenix, Ariz. (339 m.)				San Diego, Calif.[1] (19 m.)				Sault Ste. Marie, Mich. (221 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	31	970	22.7	77	31	981	20.5	82	31	1,014	24.6	81	31	1,015	24.5	89	31	970	30.6	40	20	1,011	19.2	83	31	992	14.9	89
500	31	958	23.5	70	31	958	20.6	75	31	959	22.0	84	31	960	24.1	77	31	953	32.8	36	20	957	18.0	74	31	960	16.1	75
1,000	31	904	22.4	63	31	905	19.2	69	31	905	19.1	90	31	906	21.0	79	31	902	30.9	34	20	903	23.3	36	31	906	14.5	71
1,500	31	854	19.3	64	31	853	16.8	66	31	854	16.4	86	31	855	18.0	78	31	852	27.3	36	20	853	23.8	27	31	853	11.5	72
2,000	31	805	16.5	62	31	804	13.9	64	31	805	14.9	71	31	806	15.2	74	31	805	23.1	40	20	804	21.4	28	31	803	8.8	71
2,500	31	759	13.9	61	31	758	10.9	62	31	759	13.1	52	31	760	12.5	65	31	760	18.8	47	20	758	18.0	26	31	756	6.2	68
3,000	31	715	10.8	63	31	714	8.3	61	31	715	10.8	41	31	716	9.7	58	31	717	15.0	52	15	716	14.3	29	31	711	3.5	66
4,000	31	634	4.3	65	31	632	2.1	61	31	633	5.1	33	31	634	3.7	53	31	636	7.7	61	12	635	6.7	32	30	628	−1.6	60
5,000	31	560	−1.6	59	30	558	−3.9	55					22	561	−2.6	56	31	563	0.8	63	12	561	−0.7	27	30	553	−7.1	57
6,000	30	493	−7.5	51	30	490	−9.5	48					7	494	−8.4	52	31	496	−5.6	62	12	495	−7.0	20	29	486	−13.5	54
7,000	30	433	−13.5	47	29	430	−15.7	44					7	484	−14.4	50	31	436	−12.0	54	12	435	−13.5	15	28	426	−20.2	50
8,000	30	379	−20.9	46	29	376	−22.7	43					7	381	−21.0		31	382	−18.9	47	12	380	−20.7		28	370	−27.5	50
9,000	29	330	−28.1	44	29	327	−30.4	41					6	332	−28.7		31	333	−26.6	44	12	331	−28.5		27	322	−34.6	47
10,000	29	287	−35.9	42	29	284	−38.1	41					6	288	−36.6		29	290	−34.3	42	11	288	−35.6		27	279	−41.6	
11,000	29	248	−43.7		28	245	−45.0						6	249	−44.6		29	251	−42.1		11	249	−43.1		27	240	−47.4	
12,000	29	213	−51.1		28	211	−51.1						6	214	−53.2		29	216	−49.8		11	213	−50.6		27	206	−52.0	
13,000	29	182	−57.6		28	181	−55.7										29	185	−56.9		9	185	−59.0		26	176	−55.4	
14,000	27	155	−63.0		26	154	−59.3										29	158	−62.8		8	157	−63.5		25	151	−57.3	
15,000	25	132	−67.1		24	131	−61.4										28	134	−67.2		7	133	−68.4		25	128	−58.4	
16,000	24	112	−69.0		24	112	−62.3										27	113	−68.8		7	113	−69.9		25	110	−58.6	
17,000	22	95	−68.0		21	95	−62.2										21	96	−68.7		6	96	−66.7		21	94	−57.4	
18,000	19	80	−65.3		19	81	−60.6										19	81	−66.3						16	80	−55.8	
19,000	18	68	−62.6		16	69	−68.0										11	69	−62.4						13	68	−54.2	
20,000	14	58	−59.6		9	59	−55.5										6	58	−59.4									
21,000	7	49	−58.3														5	50	−57.3									

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level																				Late report July 1940			
	Seattle, Wash.[1] (27 m.)				St. Thomas, V. I.[1] [2] (8 m.)				Washington, D. C.[1] (7 m.)				Atlantic Station No. 1[3] (5 m.)				Atlantic Station No. 2[4] (5 m.)				Portland, Maine (19 m.)			
	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.	Number of obs.	P.	T.	R. H.
Surface	31	1,014	17.5	73	30	1,016	28.4	79	18	1,019	21.2	87					30	1,023	23.5	85	13	1,014	15.0	92
500	31	960	16.6	62	30	961	22.6	96	18	961	19.1	76					30	966	19.4	86	13	959	17.9	65
1,000	31	905	14.4	58	30	907	19.4	87	18	907	16.6	76					30	912	16.3	81	13	905	14.4	65
1,500	31	853	12.1	55	30	855	16.8	79	18	855	14.5	73					30	860	14.0	77	13	852	10.7	70
2,000	31	803	9.5	56	30	806	14.8	64	18	806	12.4	67					29	810	11.6	74	13	803	6.8	74
2,500	31	756	7.1	52	30	760	12.5	55	18	758	10.2	60					29	762	9.0	65	13	755	4.3	74
3,000	31	711	4.8	38	30	716	9.8	51	18	714	8.4	48					29	718	6.7	61	12	710	1.4	75
4,000	31	628	−.3	30	30	634	3.7	49	18	632	3.3	40					29	635	1.3	52	12	626	−4.6	69
5,000	30	553	−6.3	33					18	558	−2.4	34					27	560	−4.1	49	12	551	−10.6	60
6,000	29	486	−12.8	35					18	491	−8.4	37					27	493	−9.8	50	12	483	−17.4	54
7,000	27	426	−19.8	36					18	432	−14.6	41					27	433	−16.0	48	12	422	−24.8	52
8,000	26	372	−27.2	34					10	378	−21.3						27	378	−22.9	47	12	367	−32.2	51
9,000	22	322	−34.9	35					10	329	−28.5						27	329	−30.5	48	12	318	−40.1	
10,000	19	279	−42.4						10	286	−35.8						27	285	−38.3	50	12	274	−45.9	
11,000	16	240	−49.2						8	246	−43.3						25	246	−46.2		12	236	−50.7	
12,000	13	206	−54.4						8	212	−50.6						25	211	−53.9		12	202	−54.6	
13,000	10	176	−56.7						8	182	−56.6						25	180	−59.9		12	173	−56.3	
14,000	6	151	−58.0						5	155	−61.4						24	154	−62.6		12	147	−55.6	
15,000	6	128	−59.0						5	132	−65.0						24	130	−62.6		12	126	−56.5	
16,000																	23	111	−61.9		11	108	−56.5	
17,000																	21	94	−60.4		8	92	−55.9	
18,000																	16	80	−58.5		8	79	−55.2	
19,000																	9	68	−57.0					

[1] U. S. Navy.
[2] Airplane observations.
[3] In or near the 5° square:

Lat. 35°00′ N. to 40°00′ N.
Long. 55°00′ W. to 60°00′ W.

[4] In or near the 5° square:

Lat. 40°00′ N. to 45°00′ N.
Long. 40°00′ W. to 45°00′ W.

[5] Airplane observations and radiosondes.

NOTE.—All observations taken at 12:30 a. m. 75th meridian time, except those at Washington, D. C., and Lakehurst, N. J., where they are taken before 5 a. m., 75th meridian time. At Norfolk, Va., observations are taken at about 6 a. m., and at Pearl Harbor, T. H., after sunrise.

None of the means included in this table are based on less than 15 surface or 5 standard level observations.

Number of observations refers to pressure only, as temperature and humidity data are missing for some observations at certain levels; also, the humidity data are not used in daily observations when the temperature is below −40.0° C.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during August 1940. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (870 m.)			Brownsville, Tex. (7 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	127	1.9	29	264	0.5	30	51	1.1	31	74	1.3	31	70	0.7	31	310	4.6	31	136	5.9
500							30	26	1.2										31	138	6.3
1,000	31	128	1.7				30	38	1.1				31	95	.2	31	312	4.6	31	153	4.2
1,500	31	149	1.4				30	83	.3	31	67	1.8	28	249	.6	31	324	3.7	30	159	2.7
2,000	31	157	1.0	29	266	1.3	29	285	.8	31	62	.7	27	271	2.4	31	309	3.0	28	169	1.7
2,500	29	200	1.2	29	245	.6	25	288	2.3	31	303	1.2	26	293	2.8	31	282	3.8	25	179	1.1
3,000	28	264	1.1	29	272	1.3	25	267	3.0	31	282	3.4	25	284	5.5	31	260	5.0	24	177	1.7
4,000	20	295	2.4	29	325	2.6	21	282	3.1	31	271	7.7	21	299	7.6	31	249	7.1	24	210	1.4
5,000	15	308	4.1	28	324	3.8	20	283	4.1	30	274	9.7	19	300	8.0	31	247	9.2	21	187	.7
6,000	14	289	5.6	24	319	3.9	17	294	3.7	29	269	10.7	18	304	8.2	31	243	9.4	19	166	.4
8,000	12	291	6.9	21	289	5.6	14	270	5.7	25	281	12.2	13	298	10.4	26	243	9.1	14	351	1.1
10,000	11	293	7.9	20	285	10.0	11	289	5.6	21	285	15.2	10	304	12.3	21	249	10.0	12	39	4.9
12,000	10	300	10.0	15	297	11.5				14	281	16.8				15	256	14.5			
14,000				13	274	8.5										10	256	15.4			
16,000				13	284	5.4															

Altitude (meters) m. s. l.	Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston, S. C. (18 m.)			Chicago, Ill. (192 m.)			Cincinnati, Ohio (157 m.)			Denver, Colo. (1,627 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	79	0.9	31	207	1.3	29	105	1.4	31	46	0.7	31	108	0.6	31	7	1.5
500	31	141	.7	31	219	3.0	29	112	2.8	31	86	1.7	31	155	1.2			
1,000	30	218	1.9	30	231	2.3	28	86	1.8	29	198	2.3	31	180	1.6			
1,500	28	235	2.4	29	252	3.4	27	68	.7	28	226	3.0	30	210	1.6			
2,000	27	236	2.4	28	266	4.6	25	289	1.3	27	234	4.4	27	217	2.3	31	355	2.3
2,500	24	267	3.9	24	270	4.8	23	307	1.9	24	248	4.9	24	237	2.6	31	8	1.6
3,000	21	280	3.8	20	264	3.7	17	284	2.2	22	266	5.3	21	222	2.1	31	9	1.4
4,000	18	283	4.9	18	286	5.5	12	276	1.4	17	264	5.2	16	206	1.7	31	333	4.5
5,000	13	297	5.9	15	298	7.2	10	326	3.3	14	275	7.0	10	271	1.7	26	320	5.5
6,000	11	290	6.5	10	298	8.3				11	272	8.9				19	320	7.1
8,000										11	264	11.7				13	325	9.2
10,000																11	329	7.5
12,000																		
14,000																		
16,000																		

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)			Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (766 m.)			Jacksonville, Fla. (14 m.)			Las Vegas, Nev. (570 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	178	1.3	31	221	1.9	31	352	1.5	24	37	1.6	31	271	0.4	28	114	2.5	31	162	3.5
500										24	44	1.8				27	141	2.5			
1,000										24	94	1.1	31	269	.9	24	220	1.7	31	174	3.8
1,500	31	188	1.4				31	347	1.7	23	196	.3	31	216	1.8	22	269	1.9	31	184	3.7
2,000	31	156	.9	31	216	2.4	31	331	1.7	22	276	1.3	31	234	1.5	23	290	2.3	31	195	4.1
2,500	31	123	1.2	31	216	2.8	31	286	2.0	19	297	3.2	31	230	4.6	22	296	2.5	31	207	4.3
3,000	31	94	1.9	31	224	3.1	31	288	3.1	19	285	5.0	30	237	6.9	21	295	2.6	31	205	5.2
4,000	28	52	1.3	30	222	3.6	31	292	3.3	14	274	5.2	25	257	9.1	19	267	1.9	30	214	5.3
5,000	24	30	1.7	27	217	4.8	28	295	4.1	12	286	6.0	24	267	12.3	19	270	2.1	28	215	3.7
6,000	21	22	2.5	22	226	6.1	24	290	3.6				19	269	12.2	16	290	2.2	27	221	3.5
8,000	14	267	1.3	15	249	7.3	10	274	6.4							17	311	2.1	26	238	4.9
10,000				10	265	14.5										12	329	4.5	23	259	8.1
12,000																10	323	10.8	23	258	11.6
14,000																			21	274	10.1
16,000																			20	253	3.4
18,000																			16	118	2.0

Altitude (meters) m. s. l.	Little Rock, Ark. (79 m.)			Medford, Oreg. (410 m.)			Miami, Fla. (10 m.)			Minneapolis, Minn. (261 m.)			Mobile, Ala. (10 m.)			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	30	152	1.7	31	306	1.5	31	112	1.8	31	92	0.9	31	170	2.0	31	10	0.9
500	30	146	1.3	31	312	2.2	31	136	1.4	31	114	1.0	31	190	2.1	31	28	.8
1,000	29	166	.8	31	330	2.1	31	177	.6	26	256	.6	30	123	.8	31	19	.9
1,500	27	161	.3	31	284	1.7	31	226	.5	24	239	1.4	29	9	.9	31	350	.4
2,000	27	144	.7	31	209	2.2	31	221	1.0	18	251	1.5	27	345	.9	31	305	.5
2,500	23	154	1.1	31	199	3.3	31	225	1.0	17	298	1.9	26	348	.6	25	264	1.7
3,000	15	133	1.1	31	210	4.5	30	216	1.3	14	272	3.5	25	292	.8	21	267	1.9
4,000	14	118	.6	30	218	5.4	24	242	1.6	10	257	4.8	20	238	2.9	10	291	4.2
5,000	10	298	4.0	30	231	6.5	22	181	1.2				18	242	3.5			
6,000				30	233	7.3	18	117	1.6				15	243	4.0			
8,000				30	241	9.5	13	79	2.0									
10,000				28	237	12.6												
12,000				25	234	13.5												
14,000				19	246	19.7												
16,000				10	251	13.7												
18,000																		

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (344 m.)			Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	29	147	1.6	31	281	5.0	31	158	2.2	31	147	1.4	31	238	1.5	31	116	1.9	30	213	1.2
500	29	162	2.0	30	269	3.0	31	162	2.7	31	145	1.7	31	236	1.9				30	222	1.1
1,000	27	225	.4	29	222	3.1	31	164	2.4	31	194	1.8	31	247	2.3	31	116	1.9	29	201	1.3
1,500	25	268	1.9	29	200	3.3	30	167	2.1	30	220	2.8	31	240	2.3	31	137	1.2	28	199	2.6
2,000	20	286	2.9	29	193	3.6	29	204	1.6	30	247	4.0	31	228	2.0	31	161	.8	28	219	3.0
2,500	17	299	5.1	29	181	3.7	27	275	1.9	28	275	5.0	31	213	1.2	30	240	1.1	24	265	3.8
3,000	13	278	5.3	29	186	3.6	26	292	2.7	27	281	5.6	31	231	.5	29	288	4.5	22	283	4.8
4,000				29	201	5.0	22	324	3.7	24	290	7.6	31	67	1.7	28	305	6.5	19	281	5.9
5,000				29	201	5.4	20	316	5.7	20	292	9.8	30	89	1.7	23	309	7.8	16	286	6.5
6,000				27	210	5.9	16	298	5.7	18	293	10.1	28	76	.5	22	303	10.0	14	275	6.2
8,000				26	210	7.8	10	286	6.7	10	287	13.4	26	292	1.4	15	314	11.9			
10,000				22	233	12.5							22	272	5.0	13	308	13.9			
12,000				18	248	13.4							20	270	9.8	13	308	15.9			
14,000				13	238	17.0							13	288	5.3	12	294	11.6			
16,000													10	157	1.4	10	275	7.6			

Altitude (meters) m. s. l.	San Antonio, Tex. (183 m.)			San Diego, Calif. (15 m.)			Sault Ste. Marie, Mich. (230 (m.)			Seattle, Wash. (14 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (10 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	119	1.7	31	266	3.9	30	199	1.0	31	292	2.0	31	241	2.8	29	90	1.2
500	31	116	2.0	31	288	2.2	30	177	1.2	31	312	1.3				29	113	2.5
1,000	31	118	1.7	30	303	2.6	29	222	1.4	26	290	1.4	31	237	3.4	25	150	2.3
1,500	31	127	1.7	30	296	2.0	28	241	2.1	24	291	.7	31	243	3.0	19	222	2.2
2,000	29	135	.8	30	242	1.4	28	259	2.4	22	237	2.2	30	226	2.9	16	257	3.1
2,500	27	154	.8	30	199	1.6	24	265	2.6	19	230	2.7	29	235	4.4	16	254	4.1
3,000	25	302	.4	29	180	2.5	22	276	3.9	17	239	2.9	29	238	6.0	16	257	4.7
4,000	24	299	1.5	26	181	3.3	16	265	5.9	16	249	4.6	29	247	9.0	14	259	6.2
5,000	20	313	1.5	24	196	3.3	15	262	5.7	15	255	6.1	26	251	12.0	12	259	5.5
6,000	20	313	3.3	20	219	3.5	12	262	5.3	15	254	8.7	25	252	13.5	12	264	8.1
8,000	17	327	1.5	11	240	4.6							23	259	16.2	10	265	8.4
10,000	14	360	2.7										17	266	17.0			
12,000													13	270	21.1			
14,000																		
16,000																		

TABLE 3.—*Maximum free air wind velocities (m. p. s.), for different sections of the United States, based on pilot-balloon observations during August 1940*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station
Northeast [1]	24.1	WNW	1,000	25	Caribou, Maine	37.1	SSW	3,260	24	Elmira, N. Y.	45.2	WNW	16,200	15	Albany, N. Y.
East-Central [2]	31.1	ESE	2,370	12	Knoxville, Tenn.	28.8	ESE	2,501	12	Knoxville, Tenn.	44.0	W	16,840	4	Nashville, Tenn.
Southeast [3]	27.4	E	1,600	11	Spartansburg, S. C.	21.7	E	2,501	11	Spartansburg, S. C.	47.0	ENE	33,482	31	Miami, Fla.
North-Central [4]	39.0	NNW	1,260	15	Minneapolis, Minn.	36.6	NW	4,600	24	Alpena, Mich.	53.6	W	9,540	5	Huron, S. Dak.
Central [5]	30.9	SW	1,580	24	Dodge City, Kans.	33.2	SW	3,220	26	Wichita, Kans.	42.0	WNW	12,340	6	Omaha, Nebr.
South-Central [6]	35.0	SSW	1,900	3	Amarillo, Tex.	23.2	SW	3,910	27	Oklahoma City, Okla.	35.0	WNW	9,510	27	Big Spring, Tex.
Northwest [7]	33.0	NW	1,143	9	Ellensburg, Wash.	37.2	SW	3,556	31	Havre, Mont.	45.6	SW	7,820	1	Ellensburg, Wash.
West-Central [8]	42.0	NNW	2,240	7	Casper, Wyo.	26.5	NNW	2,501	10	Cheyenne, Wyo.	47.8	W	11,395	3	Rock Springs, Wyo.
Southwest [9]	22.8	E	2,000	18	El Paso, Tex.	26.4	E	2,910	18	El Paso, Tex.	46.5	W	13,120	26	Phoenix, Ariz.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania and Northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, Southern Ohio, Kentucky, Eastern Tennessee and North Carolina.
[3] South Carolina, Georgia, Florida and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except extreme West Texas) and Western Tennessee.
[7] Montana, Idaho, Washington and Oregon.
[8] Wyoming, Colorado, Utah, Northern Nevada and Northern California.
[9] Southern California, Southern Nevada, Arizona, New Mexico, and extreme West Texas.

TABLE 4.—*Mean altitudes and temperatures of significant points identifiable as tropopauses during August 1940, classified according to the potential temperatures (10° intervals between 290° and 409° A.) with which they are identified (based on radiosonde observations)*

Potential temperatures, °A.	Bismarck, N. Dak.			Brownsville, Tex.			Charleston, S. C.			Denver, Colo.			Ely, Nev.			El Paso, Tex.			Great Falls, Mont.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.
290–299																					
300–309																					
310–319																					
320–329	7	9.0	−36.1							1	9.0	−36.0	2	9.7	−42.0				11	9.8	−44.1
330–339	23	10.7	−47.6	1	11.8	−56.0	2	11.8	−57.5	15	10.6	−44.7	12	10.5	−44.3	3	9.8	−37.3	32	11.2	−52.3
340–349	18	11.9	−53.1	12	11.8	−48.8	14	12.3	−54.6	17	11.9	−51.8	29	11.8	−51.2	18	12.1	−51.8	14	12.3	−57.6
350–359	13	13.0	−57.3	14	13.3	−57.7	18	13.7	−62.9	8	13.5	−61.8	12	13.4	−60.2	11	13.8	−62.5	2	13.8	−62.5
360–369	4	13.8	−58.8	13	15.0	−67.8	10	14.8	−67.5	15	14.4	−63.5	16	14.4	−63.9	13	14.7	−67.3	8	14.1	−61.5
370–379	5	14.7	−61.2	10	16.0	−72.7	6	15.5	−69.2	5	15.5	−68.0	16	15.2	−65.6	9	15.7	−69.8	4	14.3	−59.5
380–389	9	15.0	−60.1	8	16.4	−71.9	5	16.3	−71.2	8	15.8	−65.2	6	15.6	−65.5	2	16.4	−71.0	5	15.0	−61.2
390–399	1	15.4	−58.0	4	16.9	−72.0	3	16.5	−69.0	2	16.2	−65.0	6	16.0	−63.8	4	16.8	−70.8	4	15.8	−62.0
400–409	5	15.9	−57.8	1	17.2	−69.0				2	16.6	−65.0	2	16.4	−63.0	5	17.1	−68.2	3	16.0	−61.7
Weighted means		12.4	−52.7		14.5	−63.3		14.0	−63.2		13.2	−56.9		13.3	−57.4		14.1	−61.6		12.3	−54.9
Mean potential temperature °A. (weighted)	352.0			365.0			359.0			356.6			358.5			363.4			348.7		
No. days with observations	27			23			22			23			29			20			30		

Potential temperatures °A.	Joliet, Ill.			Lakehurst, N. J.			Medford, Oreg.			Nashville, Tenn.			Oakland, Calif.			Oklahoma City, Okla.			Omaha, Nebr.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.
290–299																					
300–309																					
310–319	2	10.6	−57.5																		
320–329	4	9.7	−44.5	3	9.2	−40.3	1	10.7	−53.0	1	8.7	−34.0	3	9.4	−44.3				5	9.4	−43.6
330–339	8	10.7	−47.5	9	10.5	−46.2	9	10.8	−48.2	5	10.7	−47.8	18	10.4	−44.8	10	10.2	−41.0	11	10.2	−43.0
340–349	11	11.8	−52.3	24	12.4	−57.0	14	12.3	−55.9	8	12.7	−58.4	19	11.7	−50.2	21	12.2	−55.0	19	12.0	−52.2
350–359	10	13.3	−59.7	7	13.2	−59.6	3	12.6	−56.0	17	13.6	−61.9	8	13.3	−59.2	11	13.4	−60.6	9	13.3	−59.7
360–369	12	14.3	−63.0	8	14.3	−63.9	2	13.7	−59.0	12	14.6	−66.9	11	14.3	−63.2	17	14.7	−66.8	9	14.2	−61.7
370–379	4	15.1	−64.2	6	14.7	−65.5	3	14.9	−64.0	8	15.6	−68.4	11	15.3	−67.3	8	15.6	−70.4	7	14.6	−61.4
380–389	8	15.4	−63.9	8	15.6	−65.5	7	15.6	−64.6	5	16.1	−70.4	4	15.8	−67.8	7	16.0	−68.7	6	15.3	−61.2
390–399	1	16.5	−65.0	3	16.1	−65.3	3	15.8	−62.7	7	16.3	−67.6	8	16.1	−67.0	4	16.6	−68.8	7	16.1	−63.9
400–409	1	16.2	−60.0	1	16.5	−66.0	3	16.5	−63.3	3	17.0	−67.7	5	16.5	−64.2	1	17.3	−70.0	3	16.3	−62.7
Weighted means		13.1	−57.3		13.1	−58.1		13.3	−57.3		14.3	−63.2		13.1	−56.7		13.6	−60.2		13.0	−55.4
Mean potential temperature °A. (weighted)	355.7			355.7			359.4			363.8			358.2			358.6			358.3		
No days with observations	24			29			15			25			28			24			25		

TABLE 4.—*Mean altitudes and temperatures of significant points identifiable as tropopauses during August 1940, classified according to the potential temperatures (10° intervals between 290° and 409° A) with which they are identified (based on radiosonde obesrvations)*—Continued

Potential temperatures °A.	Phoenix, Ariz.			Sault Ste. Marie, Mich.			Atlantic Sta. No. 2 [2]		
	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m.s.l.	Mean temperature °C.
290–299									
300–309				1	7.3	−37.0			
310–319				3	8.7	−44.0	1	8.7	−45.0
320–329				10	10.0	−49.5	1	9.7	−49.0
330–339	5	11.6	−56.0	13	10.9	−51.0	7	11.5	−53.7
340–349	14	12.1	−51.4	10	12.1	−54.8	26	12.5	−57.5
350–359	15	13.7	−61.6	12	13.0	−57.2	11	13.5	−61.6
360–369	20	14.8	−67.6	5	14.1	−62.6	7	14.5	−65.4
370–379	9	15.4	−68.2	6	14.0	−57.7	5	15.0	−64.8
380–389	6	16.4	−72.2	9	15.0	−60.3	1	15.6	−61.0
390–399	9	16.7	−69.9	3	16.2	−63.0	3	15.9	−66.3
400–409									
Weighted means		14.3	−63.5		12.4	−54.9		13.1	−59.4
Mean potential temperature °A. (weighted)	362.9			350.5			351.4		
No. days with observations	28			26			25		

[2] In or near the 5° square, lat. 40°00′N. to 45°00′N., long. 40°00′W. to 45°00′W.

WEATHER ON THE NORTH ATLANTIC OCEAN

By H. C. Hunter

Atmospheric pressure.—The pressure was above normal, on the average, over most parts of the North Atlantic area which are covered by available reports. The excess was noteworthy over the west-central portion, where the Nantucket station reported a positive departure of 5.1 millibars (0.15 inch). The north-central West Indies region and the northern part of the Gulf of Mexico had pressure somewhat below normal.

The extremes of pressure in the vessel reports now at hand were 1,032.5 and 993.2 millibars (30.49 and 29.33 inches, respectively). The high mark was recorded on the American liner *Extavia*, near 40° N., 27° W., during the forenoon of the 5th. The low mark was noted not quite 100 miles to east-southeastward of Charleston, S. C., very early on the 11th, by the American steamship *Tydolgas*, which was then in the north semicircle of the second of the August tropical disturbances.

In some land areas affected by the first or the second of these cyclones it is noteworthy that stations near the coast recorded much lower readings than that of the *Tydolgas*, the lowest of these shore readings being 974.7 millibars (28.78 inches) at Savannah on the 11th.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, August 1940*

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Lisbon, Portugal	1,018.5	+1.9	1,023	17	1,011	20
Horta, Azores	1,023.8	+0.9	1,030	9	1,015	25, 26
Belle Isle, Newfoundland [1]	1,014.0	+1.8	1,029	23	999	26
Halifax, Nova Scotia [2]			1,032	30	1,010	20, 21
Nantucket	1,020.7	+5.1	1,031	11	1,004	20
Hatteras	1,017.3	+1.4	1,024	12	1,005	19
Turks Island	1,015.6	−1.7	1,017	[3] 2	1,010	6
Key West	1,015.2	0.0	1,019	30	1,012	20
New Orleans	1,014.6	−0.6	1,020	31	1,006	6

[1] For 24 days.
[2] For 20 days.
[3] Also 5 later dates.

NOTE.—All data based on available observations, departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

For those portions of the North Atlantic remote from the tropics the lowest reading found was 997.3 millibars (29.45 inches), noted on the United States Army transport *American Legion*, near the coast of northwestern Norway on the morning of the 18th.

Cyclones and gales.—On the ocean areas north of the 34th parallel of latitude there was little storminess worth mentioning. One occurrence of force 10 (whole gale) is indicated in the table of storms, this coming during the night of the 26th–27th at the location of the United States Coast Guard cutter *Champlain*, about 39° N.,59° W. A LOW of considerable strength for the time of year had moved east-northeastward off the coast of Labrador during the preceding day, and a narrow trough extended southward from the center to about the 35th parallel of latitude, causing strong shifting winds within a small strip.

Disturbances of the tropical region.—Three cyclones affected the North Atlantic waters within the tropics and a short distance outside during the month. The first two of these are described elsewhere in this REVIEW, but the third storm is to be described in the next succeeding issue.

The earliest of these storms formed east of Florida on the 2d or 3d and moved slowly to the coast of southwestern Louisiana by the 7th, seemingly never reaching hurricane intensity, though one vessel met a force 11 wind.

The second storm traveled northwestward from the vicinity of St. Thomas on the 5th to the coast of South Carolina on the 11th. During the final hours of its passage over water there were hurricane force winds, as noted by two vessels. The tracks of the first and second storms are indicated on an accompanying map.

The third storm, coming from the southeastward, was not far off Hatteras when the month ended.

Fog.—Reports indicate much less fog than normal, especially near New England and Nova Scotia. However, the foggiest 5° square for the entire North Atlantic ocean area was in this section, 40° to 45° N., 65° to 70° W., where fog was observed on 5 days, the normal August occurrence there being 17 days.

During the 9-day period, 9th to 17th, there was no fog in any part of the ocean that available reports were covering on those days.